



### 5.4.13 Wildfires

#### History

Wildfires burn thousands of acres in Arizona annually. During the period 1996-2006, Arizona had an average of 3,208 fires annually, affecting an average of 218,762 acres. On average, 53% of the wildfires were human caused, while 47% were lightning caused.

Wildfires in Arizona by Type, 1996-2006						
Year	Human Caused		Lightning Caused		Total	
	Fires	Acres Burned	Fires	Acres Burned	Fires	Acres Burned
1996	1,747	89,916	2,033	98,271	3,780	188,187
1997	1,500	8,962	1,302	9,585	2,802	18,547
1998	2,317	43,432	916	7,718	3,233	51,150
1999	1,416	50,605	1,795	31,675	3,211	82,280
2000	1,407	45,657	2,172	37,239	3,579	82,896
2001	1,820	12,762	1,347	17,741	3,167	30,503
2002	1,833	599,383	1,385	30,493	3,218	629,876
2003	1,232	114,624	1,607	74,381	2,839	189,005
2004	1,113	45,780	1,359	173,623	2,472	219,403
2005	2,716	197,683	1,196	564,429	3,912	762,112
2006	1,483	35,567	1,597	115,856	3,080	152,423
<b>Average</b>	<b>1,689</b>	<b>113,125</b>	<b>1,519</b>	<b>105,546</b>	<b>3,208</b>	<b>218,762</b>
Source: Southwest Coordination Center, 2007						

The following are some of the largest wildfires in Arizona's history:

- April 2002, the Ryan Fire burned 38,124 acres in the Canelo Hills area, about 70 miles southeast of Tucson (AZ Republic, June 20, 2003).
- June 1996, the Bridger Knoll Fire started with lightning below the North Rim of the Grand Canyon in the Kaibab National Forest. High winds whipped it out of the Canyon and onto forest land, burning 53,503 acres before it was contained (AZ Republic, June 20, 2003).
- April 1996, the Lone Fire was started by campers in the Tonto National Forest near Roosevelt Lake and eventually burned 61,370 acres of canyons and scrub-covered mountains (AZ Republic, June 20, 2003).
- 1994, the Perkins Fire burned 25,946 acres of Bureau of Land Mgmt land near Phoenix (AZ Republic, June 30, 2003).
- June 18, 1992, the largest fire in Arizona history was started when an arsonist set the Rodeo Fire on the Fort Apache Indian Reservation near the Rodeo Fairgrounds. On June 20, a second blaze began near Chediski Peak, 15 miles from the Rodeo fire. The two fires spread quickly northeast and steadily widened toward each other, combining on June 23. On June 25, President Bush declared a national disaster for Apache, Coconino, Gila, Navajo Counties, and the Fort Apache Reservation. The fire continued to burn uncontrolled until contained on July 7, by which time it had burned over 468,638 acres in Navajo, Gila, and Coconino Counties. The fire caused 30,000 people to evacuate, destroyed over 450 homes, and caused an estimated \$34 million in damages. An estimated \$50 million dollars were spent fighting the fire. Fifty-eight % of the burned area experienced high intensity burn. Extensive smoke damage occurred in Apache County outside the direct burn area. Further, the critical Little Colorado River, and Salt River watersheds are subject to increased erosion and siltation for years to come (FEMA, September 2002).
- June 1990, the Dude Fire killed six firefighters, destroyed 63 homes, and burned 24,174 acres in the Tonto National Forest, northeast of Payson (AZ Republic, June 30, 2003).
- July 1979, lightning caused the Verde Fire, which spread over 35,678 acres of Tonto National Forest land about 40 miles northeast of Phoenix. Also, the Castle Fire was caused by a lightning strike about 50 miles northwest of Phoenix in the Bradshaw Mountains, with the fire burning 28,600 acres in the Prescott National Forest (AZ Republic, June 20, 2003).



The location of significant wildfires (100+ acres) in Arizona shown in the following map, are strongly concentrated in the southeast, with particularly incident counts for Cochise, Maricopa, Pima, and Pinal Counties. Numerous counts are also apparent across the central and north-central portion of the State. Many of the wildfires Arizona has endured over the past 26 years have occurred near the State's primary population centers. Arizona, with a localized resident base that continues to expand at a significant rate, is projected to experience a growing number of wildfire events that affect this growing population. This may occur because many of Arizona's new residents may choose to live in areas that have been relatively protected from loss caused by wildfire events. This has been the circumstance because Arizona's historically small population has not necessitated the development of infrastructure needed to facilitate new construction in forested and other non-urban areas. If current development trends in Arizona's larger communities continue, however, this circumstance may change. In particular, with the burgeoning metropolitan regions of Phoenix and Tucson located near vulnerable natural features, this threat is expected to become more and more pervasive.

### **Map 31**

This information was provided for fire locations from 1980 thru 2006 that were reported at over 100 acres. This data is entirely from the USFS Fire & Aviation Management. The numerous fires less than 100 acres were not displayed because of size and map readability.

This data is significantly different from the data used in our original Plan. That report summarized 588 fires for the 35 years from 1968 to 2002. The mapped data has 1,794 records for the 27 years from 1980 to 2006. (Though we don't have that earlier data, a quick look at the 2004 report map indicates there are major omissions in many areas of the State – tribal areas (Navajo Reservation, Fort Apache Reservation, etc) and also Apache Sitgreaves National Forest and Tonto National Forest).

### **Map 32**

The 159 Identified Communities-At-Risk from wildfire that are identified on this map, includes communities from the original 2001 list plus additions made in 2005. (There may be additional communities added to this official list again later this year.) The attributes include information about the risk rating assigned, the proximate federal agency, the Community Wildfire Protection Plan (CWPP), if any, that includes the community and the year the CWPP was completed.

Additionally, the areas identified are a representation that have or are in the process of developing CWPPs. There are 14 plans that are 100% complete and signed off on. The map also includes 4 plans that we have specific areas for and are considered in development. Some of these are very near completion, the Central Navajo County one is in early stages. Not included in this data are several efforts that are underway (at various early stages) to develop plans in other areas of the state. Additional information is available through the AZ State Land Dept.

### **Map 33**

The Wildfire Hazard Areas as identified in the 2003/04 Arizona Wildland Urban Interface Assessment (WUI) Report. The WUI approach used four main data layers:

- TOPO – Aspect and Slope derived from 30 meter Digital Elevation Model data from USGS.
- Risk – Historical Fire Density using point data from fire record years 1986–1996 from all wildland agencies.
- Hazard – Fuels, natural fire regimes and condition class.
- House – House/Structures

The "Land Hazard" layer produced from this model is based on a 250-meter raster grid (some data originated at 1,000-meter) that scored and classified results. The raster values range from 1-15 and were classified into three group: High (values of 10-15), Moderate (values of 7-9), and Low (values of 1-6). This map layer will be used quantitatively for the vulnerability assessment.

### **Probability and Magnitude**

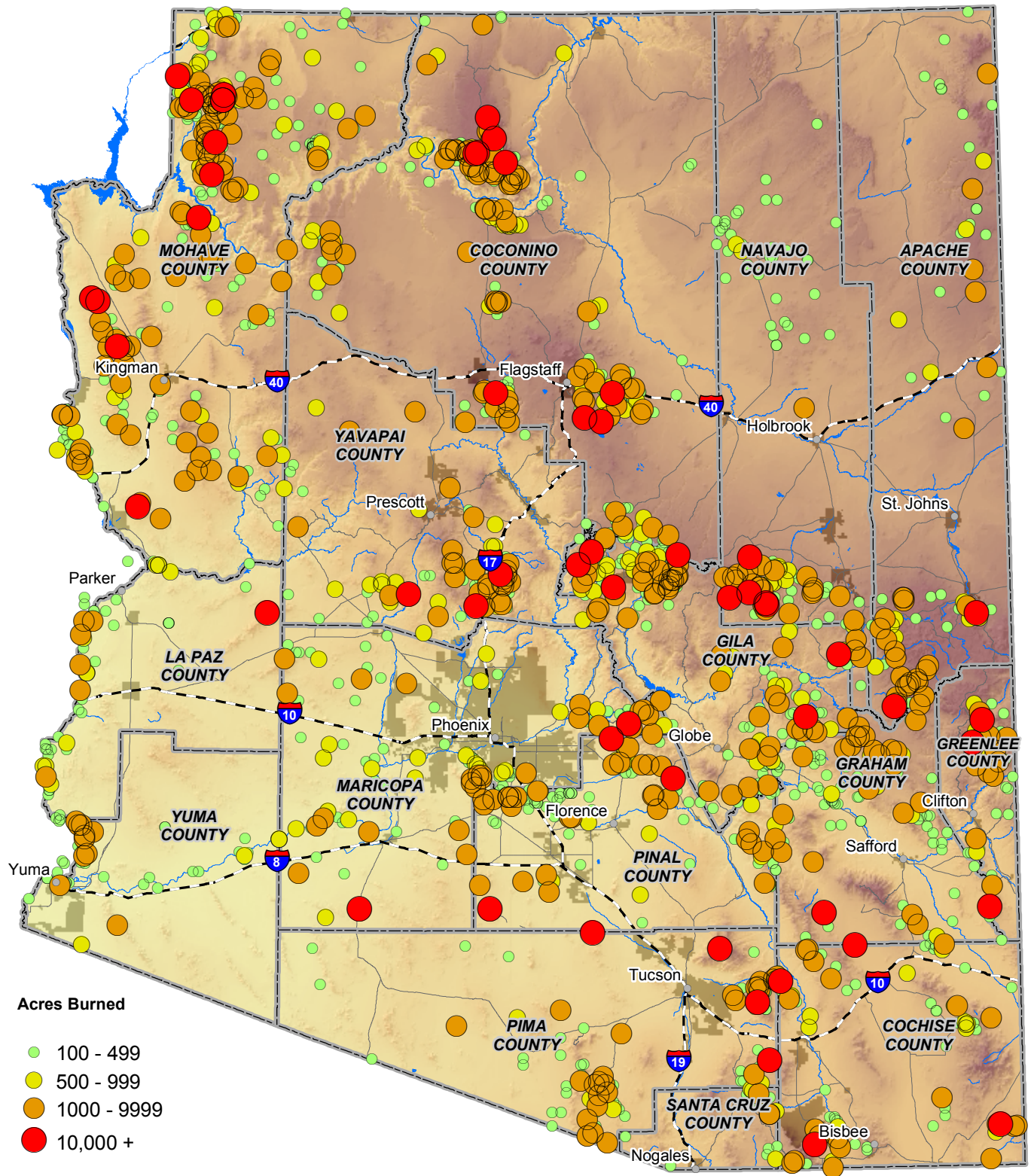
Depending upon the needs of the user and the availability of data, there are many different approaches to fire modeling. However, nationally accepted or utilized wildfire models have not been developed for the evaluation of wildfire risk or conducting vulnerability analysis. In addition, most wildfire modeling conducted to date has been focused on wildfire behavior, not true probability and magnitude modeling. This is because the probability of ignition and the probable wildfire size have generally not been considered. In addition, there have been major limitations in terms of software systems, data availability, and data coverage/resolution.

These limitations aside, with improving GIS programs and data availability, there are a growing number of wildfire hazard assessment models. In addition, as a part of the National Fire Plan, communities have also been identified across the US that are at risk to wildfires.



In an attempt to categorize the probability of future wildfire events, the hazard was analyzed using the CPRI. This method also takes into account the levels of magnitude/severity, warning time and duration. In Arizona, wildfires are highly likely, the magnitude/severity has a good possibility of being catastrophic, the warning time is less than 6 hours and the duration can easily be more than one week. These factors resulted in a CPRI rating of 4, the highest of all those rated by this method. The highest rating a hazard can result in using this method is 4.

# State of Arizona

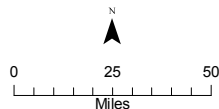


Note: 1794 records for the past 27 years.

Source: USFS Fire and Aviation Management 2007; ALRIS 2006; URS 2003

## Legend

- Major City
- County
- interstate
- Lakes
- Highway
- Cities
- Major Streams



August 2007



## State of Arizona Multi-Hazard Mitigation Plan

### Map 31 Significant Wildfires 1980 thru 2006





## Wildland Urban Interface Communities at Risk Program

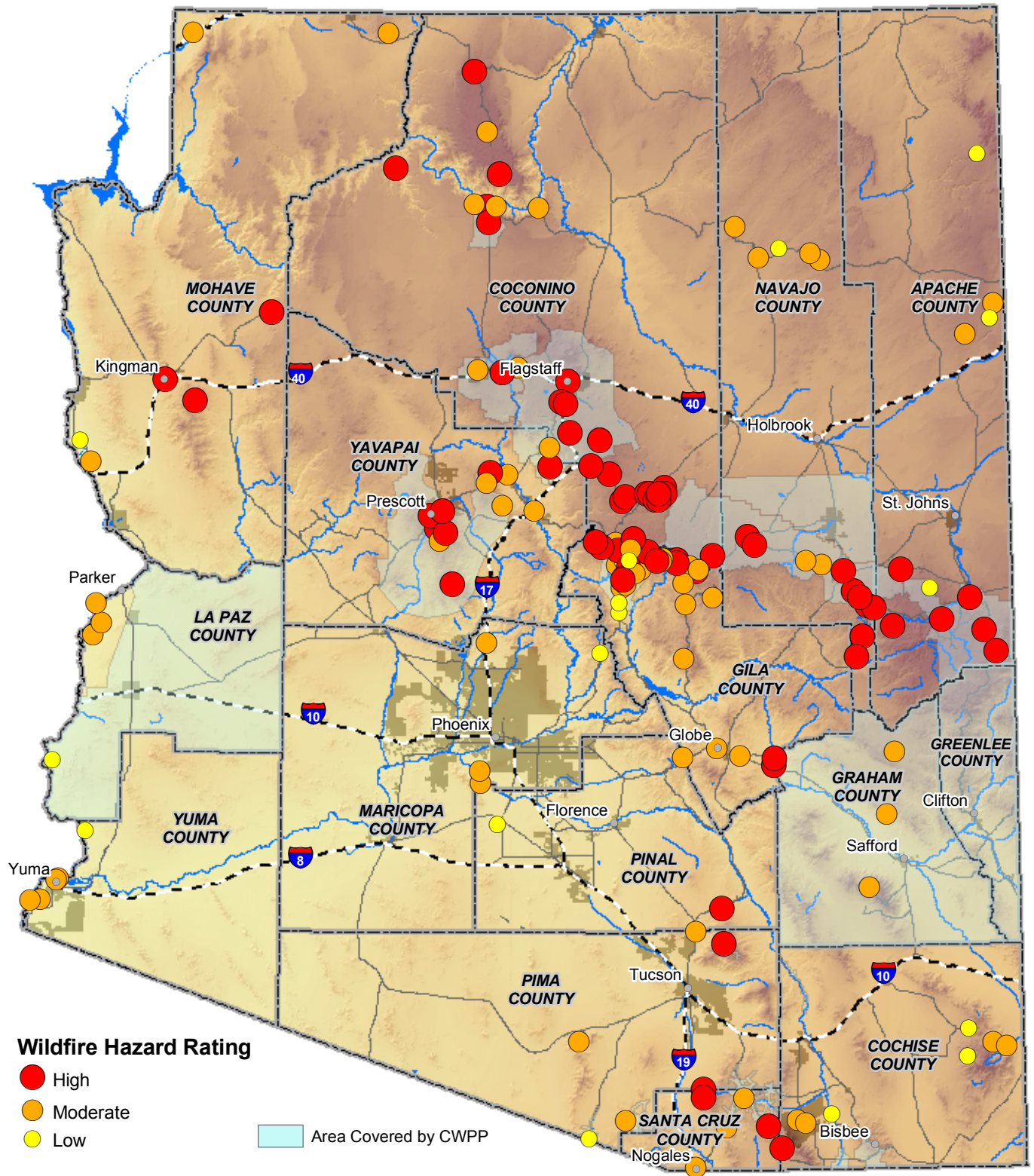
Urban wildland interface areas, where development meets wildland vegetation, where both vegetation and the built environment provide fuel for fires, have increased significantly throughout the U.S. Due to this increase, there is risk of major losses from wildfires. Following the severe wildfires during the summer of 2000, the Secretaries of Agriculture and the Interior developed the National Fire Plan, a program to reduce wildland fire risks to communities and the environment, and to save the lives of firefighters and the public. The Plan is a long-term program based on cooperation and communication among federal agencies, governments, tribes and interested publics. The program includes a 10-Year Comprehensive Strategy and an Implementation Plan.

As part of the National Fire Plan, the Wildland Urban Interface Communities at Risk Program was developed in order to reduce the risk of wildland fire in urban interface communities through education, prevention, hazardous fuels reduction, and to increase fire protection capabilities. A key step in realizing this goal was the identification of areas that are at high risk of damage from wildfire. Federal fire managers authorized state and tribal authorities to determine which communities were under significant risk from wildland fire on or in the vicinity of Federal lands. In some states, communities that are not on or within the vicinity of wildfires were also included, primarily in eastern states. States and tribes were asked to follow a consistent process established by an interagency group at the national level, or state teams could use existing community assessment systems when those systems met or exceeded the standardized process. The outcome of this process was the *Wildland Urban Interface Communities at Risk*, which was first published in the Federal Register on January 4, 2001 and revised to include additional communities on August 17, 2001.

The information contained in the revised list is used by interagency groups of land managers at the state and/or tribal level to collaboratively identify priority areas benefiting from hazardous fuels reduction. Federal land management agencies and state foresters will focus special attention on these areas in a concerted effort to reduce wildfire hazards.

Urban Wildland Interface Communities in Arizona by County as of 6/13/2007	
County	No. of Communities
Apache	12
Cochise	8
Coconino	35
Gila	40
Graham	3
Greenlee	0
La Paz	4
Maricopa	4
Mohave	8
Navajo	15
Pima	5
Pinal	3
Santa Cruz	6
Yavapai	11
Yuma	5
<b>Total</b>	<b>159</b>
Source: Arizona State Land Department, Fire Division 2007.	

# State of Arizona

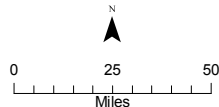


Note: CWPP - Community Wildfire Protection Plans

Source: ASLD, Forestry Division, 2005; ALRIS 2006; URS 2003

## Legend

- Major City
- County
- interstate
- Highway
- Major Streams
- Lakes
- Cities



August 2007

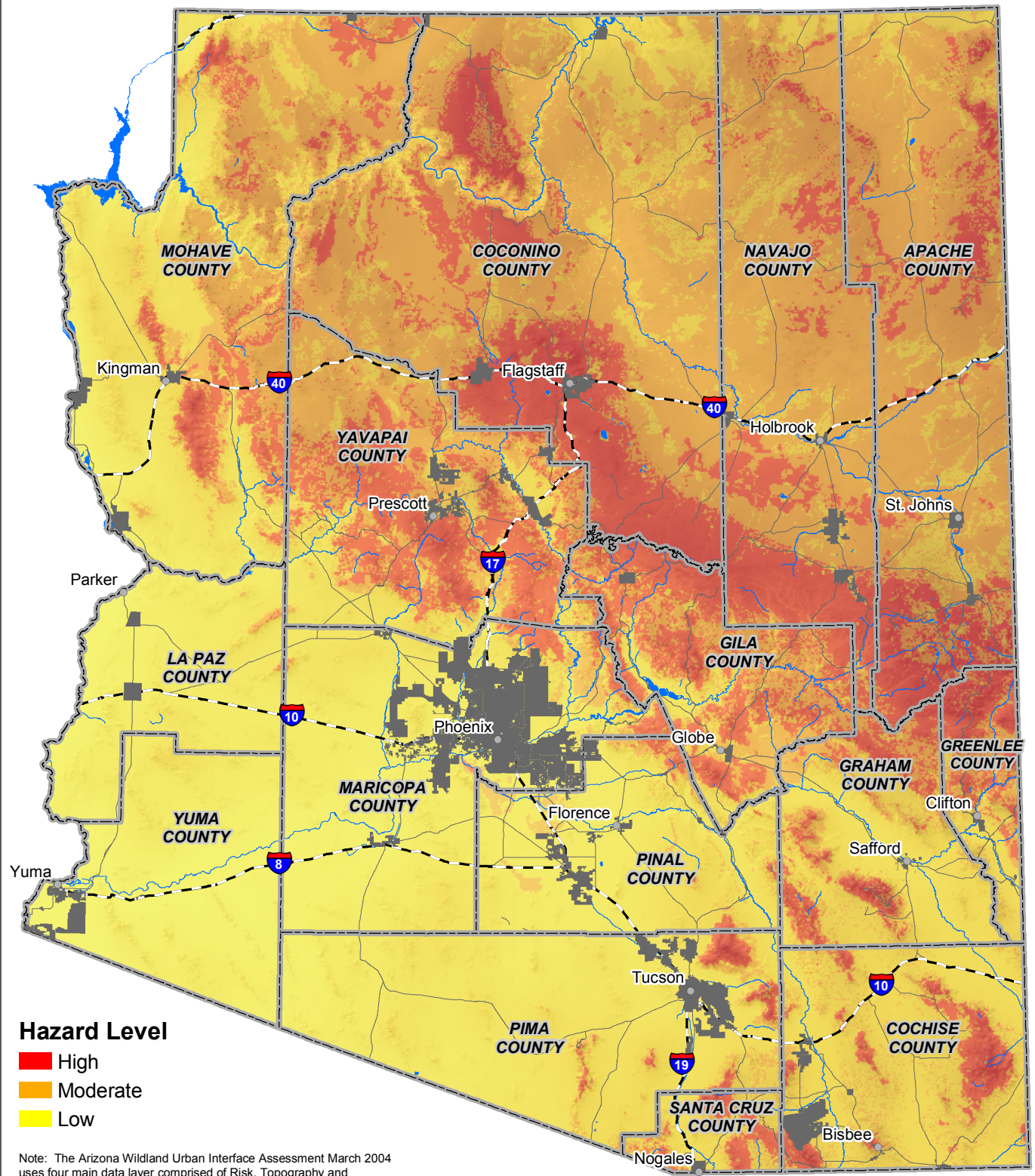


## State of Arizona Multi-Hazard Mitigation Plan

**Map 32**  
**Urban Wildland Interface**  
**Communities-at-Risk**  
as of June 2007



# State of Arizona



## Hazard Level

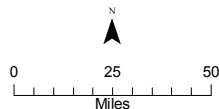
- High
- Moderate
- Low

Note: The Arizona Wildland Urban Interface Assessment March 2004 uses four main data layer comprised of Risk, Topography and House/Structure Density to determine the wildfire areas.

Source: Arizona Interagency Coordination Group, 2004 - Analysis provided by Mike Fisher (Fire Management Specialist); ALRIS 2006; URS 2003

## Legend

- Major City
- ▭ County
- interstate
- ▭ Lakes
- Highway
- ▭ Cities
- Major Streams



August 2007



## State of Arizona Multi-Hazard Mitigation Plan

### Map 33 Wildfire Hazard Areas 2004 Assessment





## Vulnerability

Estimates of asset and human exposure to wildfire are accomplished by intersecting the asset inventory and ESRI population data with wildfire land hazard map layer presented in the previous section. Exposure to wildfire hazard type “high”, were estimated for each data set. Since no common methodology is available for estimating losses from the exposed values, estimates of the loss-to-exposure ratios were assumed based on the perceived intensity of a fire hazard. The resultant losses were then compared to historic records for a level of indirect verification. The loss-to-exposure ratios for the high wildfire hazard areas were estimated to be 0.2. Economic losses are estimated assuming that the facility will be unproductive for 30 days for all scenarios. Table 5.4.13.a summarizes the asset exposures by county the “high” wildfire hazard. Table 5.4.13.b summarizes the ESRI human population exposure to the wildfire hazards.

In summary, \$60 million in wildfire losses to 224 state identified assets is estimated for all of the state of Arizona.

It is highly unlikely that any fire would burn across the entire State or County in a given event, and the incident specific damage costs are likely to be only a fraction of those presented. However, as a collective evaluation, the loss estimate seems reasonable. Regarding human vulnerability, a total population of 176,707 people, or 3% of the total state of Arizona population, is potentially exposed to at least a high wildfire hazard. Typically, deaths and injuries not related to firefighting activities are rare. However, it is feasible to assume that at least one death and/or injury is plausible. There is also a high probability of some population displacement during a wildfire event, especially in the urban wildland interface communities.

For the local risk assessment summary, Table 5.4.13.c combines asset and predominantly HAZUS information for the estimated losses as reflected in local plans. The potential total number of facilities in the hazard areas is 310,238 at a replacement cost of \$159 billion. The estimated losses for the hazard areas are approximately \$35 billion.

<b>Table 5.4.13.a: Summary of State-Owned asset inventory loss estimates based on Wildfire</b>					
Jurisdiction	Impacted Facilities		Estimated (x \$1,000)		
	Total	Percentage	Replacement Cost	Structure Loss	Total Loss
<b>Statewide Totals</b>	<b>224</b>	<b>100.00%</b>	<b>\$303,417</b>	<b>\$60,683</b>	<b>\$60,683</b>
Apache	9	4.02%	\$49,128	\$9,826	\$9,826
Cochise	3	1.34%	\$367	\$73	\$73
Coconino	75	33.48%	\$144,004	\$28,801	\$28,801
Gila	84	37.50%	\$71,175	\$14,235	\$14,235
Graham	0	0.00%	\$0	\$0	\$0
Greenlee	19	8.48%	\$1,181	\$236	\$236
La Paz	0	0.00%	\$0	\$0	\$0
Maricopa	1	0.45%	\$8,812	\$1,762	\$1,762
Mohave	1	0.45%	\$6,593	\$1,319	\$1,319
Navajo	27	12.05%	\$11,316	\$2,263	\$2,263
Pima	2	0.89%	\$424	\$85	\$85
Pinal	0	0.00%	\$0	\$0	\$0
Santa Cruz	0	0.00%	\$0	\$0	\$0
Yavapai	3	1.34%	\$10,417	\$2,083	\$2,083
Yuma	0	0.00%	\$0	\$0	\$0



Ranking of Vulnerable Communities - Wildfire (Extreme - High)	
County	Community
Yavapai	Camp Verde
Apache	Eagar
Yavapai	Cottonwood
Yavapai	Clarkdale
Coconino	Williams
Navajo	Show Low
Navajo	Pinetop-Lakeside
Yavapai	Chino Valley
Yavapai	Jerome
Apache	St. Johns

State Facilities Located in the Wildfire Hazard Area by Jurisdiction								
	DES	GF	His	ASLD	Mil	DOT / MVD	Parks	PS
Flagstaff	2	2	4	2	3		4	1
Pinetop		10						
Show Low					5			
Willcox								1
Williams						5		



Table 5.4.13.b: County population sectors exposed to Wildfire									
Jurisdiction	Population			Population of 65 yrs of age			Population under 18 yrs of age		
	Total	Exposed	Percentage Exposed	Total	Exposed	Percentage Exposed	Total	Exposed	Percentage Exposed
High Wildfire Hazard									
Statewide Totals	5,881,719	176,707	3.00%	667,760	23,449	3.51%	1,366,714	41,095	3.01%
Apache	66,601	8,788	13.19%	5,741	821	14.30%	26,722	3,445	12.89%
Cochise	125,933	6,390	5.07%	17,359	582	3.35%	30,985	1,587	5.12%
Coconino	123,505	53,526	43.34%	8,150	3,480	42.69%	33,424	12,183	36.45%
Gila	51,822	17,016	32.83%	10,154	3,661	36.06%	12,881	3,686	28.61%
Graham	34,520	670	1.94%	3,995	62	1.54%	10,102	228	2.26%
Greenlee	7,803	1,010	12.94%	840	179	21.31%	2,693	316	11.73%
La Paz	19,383	12	0.06%	5,085	4	0.07%	4,156	2	0.06%
Maricopa	3,601,880	1,655	0.05%	358,963	210	0.06%	827,999	296	0.04%
Mohave	181,965	6,983	3.84%	31,702	640	2.02%	35,823	2,248	6.27%
Navajo	102,877	27,314	26.55%	9,757	2,918	29.91%	34,523	8,446	24.46%
Pima	934,680	3,927	0.42%	119,489	539	0.45%	207,895	746	0.36%
Pinal	216,255	3,373	1.56%	29,182	819	2.81%	45,085	389	0.86%
Santa Cruz	43,485	2,621	6.03%	4,104	257	6.26%	12,888	688	5.34%
Yavapai	192,791	43,422	22.52%	36,814	9,278	25.20%	35,402	6,837	19.31%
Yuma	178,218	0	0.00%	26,425	0	0.00%	46,136	0	0.00%



Table 5.4.13.c: Summary of Local Risk Assessment & Loss Estimates based on Wildfire			
	Total Assets \$ (Assets +HAZUS) x \$1,000	# of Facilities Impacted (Assets + HAZUS)	Estimated Loss (Assets +HAZUS)
<b>Wildfire Hazard</b>			
<b>Statewide Totals</b>	<b>\$138,358,284</b>	<b>194,875</b>	<b>\$12,363,880,000</b>
Apache	\$9,574,893	24,752	\$3,212,000,000
Cochise	\$6,313,019	26,154	\$221,200,000
Coconino	-----	-----	-----
Gila	\$6,095,766	21,528	\$1,620,000,000
Graham	-----	-----	-----
Greenlee	\$34,967	87	-----
La Paz	\$613,774	752	\$17,600,000
Maricopa	\$10,192,347	54,417	-----
Mohave	-----	457	\$55,000,000
Navajo	\$10,807,793	38,188	\$2,530,000,000
Pima	\$2,760,062	12,664	-----
Pinal	-----	-----	-----
Santa Cruz	\$1,841,671	6,854	\$98,480,000
Yavapai	\$1,673,616	1,263	\$4,450,000,000
Yuma	\$88,450,376	7,759	\$159,600,000
----- Denotes lack of available information for assessment.			

**Sources:**

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